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COMPLETE SPECIFICATION

Detergent-Filled Disposable Paper Dishcloth

We, THE PROCTER & GAMBLE COMPANY, a Corporation organised under the State of Ohio, United States of America, of 301 East 6th Street, Cincinnati 2, Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to detergent impregnated fibrous structures for the cleansing of dishes and other articles.

In the cleansing of utensils such as dishes and kitchenware by hand, it is common practice to immerse them in, for example, a sink, filled with warm water containing some added cleansing substance. The cleansing substance may be either soap or a non-soap detergent surfactant composition. The non-soap surfactant compositions, however, have been found generally more effective on the greasy food soils associated with dishes. After addition of the soap or detergent, dishes may be put into the sink in any order, and the dishes are then generally scrubbed, scoured or wiped with a cloth of open, stringy weave, referred to as a dishcloth. Sponges and brushes of various types have also been used to perform the scrubbing function, although a dishcloth is customarily employed. This mechanical action aids the cleansing process by mechanically agitating the food and grease particles clinging to the dishes and by carrying the soap or detergent solution to the dish surfaces.

The action of the dishcloth is further to agitate the water solution of soap or detergent so that loosened grease and soil particles are emulsified or otherwise put into solution or suspension by action of the cleansing substance.

The disadvantage of the procedure outlined above is that it is accomplished by a more or less inexact addition of amounts of cleansing substance to the water and necessitates storing a wet dishcloth or other spongious body between dishwashing operations. In addition to the problem of where to hang the dishcloth for drying, the housewife is confronted with either the inconvenience of meticulously cleansing the dishcloth itself, after each use, or the liability of incurring a kitchen nuisance problem. This nuisance problem is made up of the mildew, odours and other products of bacterial or fungal action associated with damp porous bodies containing organic material. Various means have been suggested or employed in an attempt to eliminate the nuisance of a dishcloth and to improve the exactitude with which amounts of detergents are added to batches of soiled dishes. These means, ranging from the simple loading of a single paper sheet with soap, cleansing powder, or detergent, as disclosed in U.S. Patent Specification No. 2,112,963, to the provision of multi-layer structures such as those disclosed in U.S. Patent Specification No. 2,665,528, have all been subject to faults in such factors as the wet strength of the paper, the amount and type of detergent added, the absorbency of the structure, and the wet handling quality of the paper structure.

To alleviate these faults in the prior art it is proposed, in accordance with the present invention, to provide a disposable, uniformly detergent-loaded paper laminate having improved strength, absorptive capacity, detergent loading, handle and other desirable attributes for accomplishing the dishwashing function.

One object of this invention is to provide a disposable, uniformly detergent-loaded paper dishcloth of laminated paper construction having substantially the same wet-handling characteristics as a non-disposable dishcloth.

A further object of this invention is to provide a laminated, wet-strength, paper structure, at least one ply of which is uniformly impregnated with effective amounts of a non-soap

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detergent surfactant, whose plies are held together by a continuous open-grid pattern composed of a bonding agent which contributes wet-bursting and wet-tearing strength to the structure without substantially interferring with the lateral or vertical movement of liquids within the individual plies of the laminate.

According to the present invention, a disposable paper dishcloth comprises a detergent-loaded paper laminate of at least two plies of towelling paper the plies of said detergent-loaded paper laminate being bonded together by an open-grid pattern comprising pliable thermoplastic resin, and said laminate containing one or more anionic detergents or nonionic detergents or a mixture thereof.

According to a further aspect of the present invention a process for the manufacture of disposable dishcloths comprises printing on one ply of towelling paper an open-grid pattern composed of a pliable thermoplastic synthetic resin bonding composition, laying a second ply of towelling paper on said open-grid pattern so that the pattern is sandwiched between the plies, heating the paper laminate so formed so as to fuse the thermoplastic synthetic resin and to bond the outer fibres of the facing surfaces of said plies to said open grid pattern, treating said paper laminate on at least one surface with detergent solids applied in a liquid formulation, and drying the detergent treated paper laminate.

The features of this invention will become apparent by reference to the following description taken in conjunction with the accompanying drawing wherein:

Figure 1 is a fragmentary plan view of a two-ply embodiment of a disposable, detergent-loaded paper dishcloth with part of the top ply cut away and peeled back to show the continuous open-grid bonding employed according to the present invention;

Figure 2 is an enlarged cross sectional view of the disposable paper dishcloth of Figure 1, taken along the line 2—2, which diagrammatically depicts the ply spacing effected by the bonding grid pattern.

Figure 3 is a fragmentary plan of a three-ply embodiment of the present disposable, detergent-loaded paper dishcloth with the top and intermediate plies in part cut away and peeled back to show the continuous open-grid bonding pattern between the plies;

Figure 4 is an enlarged cross sectional view of the disposable paper dishcloth of Figure 3, taken along the line 4—4, which diagrammatically depicts the ply spacing effected between the three plies by the continuous open-grid bonding pattern.

Referring to Figures 1 and 2 of the drawing, it will be noted that, in its least complex form, the basic elements of the disposable, detergent-loaded paper dishcloth are a bottom sheet 10 of wet-strength paper bonded to a top sheet 11 of wet-strength paper by a continuous open-grid pattern of bonding lines 12 formed of a fused plastisol formulation. The term plastisol as used herein refers to plastic formulations which contain, in addition to powdered thermoplastic resins and liquid plasticizers, minor amount of a compatible release agent. Because of the addition of release agents, the preferred plastisol formulations are readily printable and may be proper members of the organosol class.

It will be understood throughout the present specification that, although the plies of the present dishcloth may be formed of wet-creped, dry-creped and uncreped wet-strength towelling papers and combinations thereof, the creped papers are preferred because of the resiliency, absorbency and surface characteristics which they contribute. In Figure 1 the continuous open-grid bonding lines are depicted as straight lines generally parallel and at angles of 45 degrees with the paper edges and forming squares; in Figure 3 the bonding lines are depicted as generally parallel, undulating or wavy lines intersecting to define approximately square areas, the sides of which are more or less parallel with the paper edges. In general, within the other limitations set forth herein, although certain patterns set forth hereinbelow are preferred, there is no limitation on the type of continuous open-grid bonding pattern employed. Therefore, it is contemplated that any continuous open-grid pattern, including squares, diamonds, touching circles and combinations thereof, is within the scope of the present invention. Likewise, although two and three ply combinations are shown and described to illustrate the present invention, laminates having four or more plies within practical limits are effective in practising the present invention and will occur to those skilled in the art. The drawing also serves to illustrate that the bond between the thermoplastic grid and the paper plies involves only the outer fibres of the plies so that the lateral movement of liquid within the individual plies is substantially unaffected.

In the manufacture of a disposable, detergent-filled paper dishcloth such as that shown in Figures 1 and 2, a bottom sheet of wet strength paper 10 is fed from a parent roll and has continuously applied to its surface, by any convenient means, a continuous open-grid bonding pattern composed of a fusible plastisol formulation. A printing system, known as intaglio, wherein pigmented bonding materials are deposited from grooves in a roller has been found preferable in the present laminate formulation, but any system capable of placing the plastisol in the required pattern is acceptable for use in forming the paper structure. These systems include, for example, offset printing and extrusion of the plastisol through orifices. Although a continuous application of plastisol to a continuous sheet is described

herein, a non-continuous system wherein individual sheets of paper are laminated, or a system wherein the feed from the above mentioned parent rolls is intermittent, can also be employed. Similarly, although the continuous system is adapted to the formation of laminates wherein the machine direction of the various plies runs in the same direction, the adoption of single sheet or intermittent systems will make possible the formation of laminates in which the machine direction of the alternate paper plies are, for example, at right angles to each other.

The base sheet, having the open-grid pattern of bonding plastisol applied thereon, is then brought into contact with another sheet on the still tacky printed side so that a bond is formed between the two sheets with the continuous bonding pattern sandwiched between the plies. With different printing arrange-arrangements, the top instead of the bottom sheet can be printed. Also, in laminates having more than two plies, the bonding pattern can be applied in any manner which provides a bonding pattern between adjacent plies. For instance, the machine direction bond lines can be formed on a second ply before bringing the pattern side of the plies together.

In a three ply embodiment of the present invention as illustrated in Figures 3 and 4, therefore, the required bonding patterns may either be printed on both surfaces of the centre sheet or on two of the plies. The three-ply embodiment depicted shows the two bonding patterns in register, which is preferable but not essential.

The plastisol pattern sandwiched between the plies is fused by subjecting the laminate to the fusion temperature of the thermoplastic resin employed in the plastisol for a sufficient length of time to fuse the powdered plastic resin together and to bond it to the outermost fibres of the adjoining plies. The time and temperature necessary to fuse and bond a given thermoplastic formulation without causing it to slump can be easily determined by those skilled in the art. It is important to fuse and bond the thermoplastic without the application of excessive heat because, if the plastic runs, ply separation will be lessened. Plastic fluidity caused by excessive heat will also permit penetration of the thermoplastic into or through the paper at the bonding lines, and is to be avoided so that the absorbency of the plies at these points is substantially undiminished. With polyvinyl chloride resins, maximum grid strengths are obtained with curing times somewhat longer than normal, for example, 350° F. for a period of about 5 minutes to about 10 minutes. Higher temperatures can also be employed for shorter periods to avoid charring the paper plies. The heat necessary to accomplish the fusion of the powdered thermoplastic in the plastisol pattern and its bonding to the outermost fibres of the paper can be applied in any convenient manner. For example, the laminate can be passed through a zone heated by electrical resistance elements, steam coils, infra red lamps or dielectric heating.

After bonding, the laminate passes from the heated zone to a relatively cooler zone, which may be at room temperature or may consist of a cooled zone in a higher speed process. This cooled zone solidifies the thermoplastic from its fused form.

One or both of the outside plies of the laminate are then impregnated or coated by spraying, dipping, doctoring, orifice or roller techniques, with solutions of detergent solids in water or organic solvents so that the detergent solids are absorbed in one or more plies of the laminate. If desired, the treated laminate can be passed between rolls to distribute the detergent further.

The detergent-treated laminate can be used without drying, but, for the purposes of packaging and distributing the product dishcloths, they are usually dried to a moisture range of between about 10% and about 50% by conventional drying methods.

Since perfumes are susceptible to loss and odour change under drying conditions, any application of these is preferably by spraying or otherwise to the detergent-impregnated dishcloths after drying.

The dishcloths are then packaged for distribution in any manner acceptable for packaging conventional towel or tissue products. These methods include, for example, cutting the dishcloth laminate stock into individual dishcloths and packaging them in dispensing boxes. The dishcloth laminate stock can also be prepared in the form of towel rolls with perforations to allow easy separation of a single dishcloth. The towel-roll type package can also be made without perforations, but with a cutter bar on the package, so that a user can dispense an individually preferred amount of dishcloth.

The wet-strength papers referred to herein may suitably be those containing urea-formaldehyde, melamine-formaldehyde, modified urea-formaldehyde and other synthetic resins conventionally used by the paper industry in the manufacture of wet strength papers. Variations in the plies, such as the use of wet-creped, dry-creped and uncreped wet strength papers in various combinations are also contemplated as being within the scope of the present invention.

It has thus been discovered that a disposable paper dishcloth comprised of a detergent-loaded paper laminate of at least two plies of paper selected from wet-creped, dry-creped and uncreped towelling papers and combinations thereof can be made to have certain unique advantages in the dishwashing operation. These advantage accrue from the combination of structure, paper bonding-agent

formulation and detergent type employed in the present disposable paper dishcloth. Among the benefits derived are the incorporation of a greater fibre weight content via multi-ply lamination to give desirable wet strength and absorbency without the stiffness resulting from the same fibre weight content employed as a single ply. A further advantage is the use, for bonding the laminate, of a plastisol formulation which is bulky and yet pliable to that a good scouring property is attained in the dishcloth, and the necessary bond to make the plies act in conjunction is achieved. All of these benefits are realized without substantially affecting the absorbency of the product dishcloth and without essentially affecting the lateral or vertical flow of liquids in its plies, since the bonding pattern affects only a small percentage, e.g. 6% or less, of the plies, and bonds only the outer fibres. For these reasons water can diffuse to portions of the dishcloth not in contact with wet surfaces and the full absorptive capacity of the dishcloths can be utilized. Another advantage accrues from the use in the combination of a plastisol formulation which has the proper pliability to prevent the dishcloth from wadding when wet with water or detergent solution and yet has sufficient resiliency to result in a cloth-like product. The use of detergent solids in combination with paper affords the advantage of retarding their release. In this manner their cleansing action persists until all the dishes are washed, and repeated use of the dishcloth can be made if a few dishes are washed at a time.

In achieving the results of the present invention it is important that the selected paper have the qualities of softness, extensibility and absorbency as well as the necessary wet-strength to withstand the rigours of dishwashing. Papers having these attributes are referred to herein as towelling papers. Although towelling paper furnishes composed of other paper-making fibres and containing or treated with other wet-strength agents can be used, the preferred paper for the practice of the present invention is a wet-creped paper containing substantially 25% sulphite hardwood fibres, substantially 74% sulphate softwood fibres and substantially 1% of a polyamide-epichlorohydrin (modified urea-formaldehyde) wet-strength resin.

The terms "wet-creped" and "dry-creped" used herein refer to papers in which the creping is accomplished in the wet and dry states, the preferred wet-creped and dry-creped papers having 1—2% crepe and 12—15% crepe respectively. Towelling papers having other percentages of crepe can also be used in this invention, although an appreciable crepe percentage is preferred because creping lends extensibility and tends to enhance such factors as the handle and the strength of the product.

Viscous plastisol formulations which have been used in the practice of the present invention are tabulated below. Percentages are by weight.

TABLE I

Plastisol Formulations

Components	A	B	C	D	E
Polyvinyl chloride	52.5%	50.0%	52.5%	59.0%	59.0%
Dipropylene glycol dibenzoate	33.0	31.5	33.0	—	—
Dibutylphthalate	—	—	—	29.0	—
Mixed alcohol phthalates	—	—	—	—	29.0
Propylene glycol	13.0%	—	—	12.0%	12.0%
Ethylene glycol	—	—	13.0%	—	—
Diethylene glycol	—	17.0%	—	—	—
Barium-Cadmium stabilizer	1.0	1.0	1.0	—	—
Pigment	0.5	0.5	0.5	—	—

The glycol components of the formulations set forth in Table I above act as release agents in the printing of the continuous open-grid bonding pattern and, should other means be used

for placing the bonding pattern on the paper, for example, extrusion through orifices on to the surface of the paper, these release agents are unnecessary.

Of the plastisol formulations set forth in the table above, Formula A is preferred and is the formulation employed in the preferred practice of this invention, although the remainder of the tabulated formulations and others of a similar type using polyethylene can be employed. It is important, however, that the plastisol formulation print cleanly, if this method of applying the bonding pattern is employed, and not slump between printing and fusing. These attributes are important to developing the scouring facility, wet-strength, and appearance of the paper dishcloth product.

Other thermoplastic resins which can be used in place of polyvinyl chloride in the plastisol binding patterns of the present invention to give corresponding advantages are: the polystyrenes, the polyamides, the ethyl celluloses, the cellulose nitrates, the cellulose propionates, the butyrates, the acetates and the acrylics.

Anionic organic detergents which can be used in the compositions of this invention alone or in admixture include both the soap and non-soap detergents, although the latter materials are preferred as stated hereinbefore. Examples of soaps which can be used are the sodium, potassium, ammonium and alkylolammonium salts of higher fatty acids (C_{10}—C_{20}). Particularly useful are the sodium and potassium salts of the mixtures of fatty acids derived from coconut oil and tallow, i.e., sodium or potassium tallow and coconut soap. Examples of anionic organic non-soap detergents are: alkyl glyceryl ether sulphonates; alkyl sulphates; alkyl monoglyceride sulphates or sulphonates; alkyl polyethenoxy ether sulphates; acyl sarcosinates; acyl esters of isethionates; acyl N-methyl taurides; alkyl benzene sulphonates; alkyl phenoxy polyethenoxy ethyl sulphates. In these compounds the alkyl and acyl groups, respectively, contain 10 to 20 carbon atoms. They are used in the form of water soluble salts, such as the sodium, potassium, ammonium or alkylolammonium salts. Specific examples are: sodium lauryl sulphate; potassium N-methyl lauroyl tauride; triethanolamine dodecyl benzene sulphonate.

Examples of nonionic organic detergents which can be used in the compositions of this invention alone or in admixture are: polyethylene oxide condensates of alkyl phenols wherein the alkyl group contains from 6 to 12 carbon atoms (e.g., t-octylphenol) and the ethylene oxide is present in a molar ratio of ethylene oxide to alkyl phenol in the range of 10:1 to 25:1; condensation products of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylene diamine wherein the molecular weight of the condensation products ranges from 5,000 to 11,000; condensation products of from about 5 to 30 moles of ethylene oxide with one mole of a straight or branched chain aliphatic alcohol containing from 8 to 18 carbon atoms (e.g., lauryl alcohol); C_{10}—C_{18} alkyl di(C_1—C_2 alkyl) amine oxides (e.g. dodecyl dimethyl amine oxide); mono and diethanolamine condensates with higher fatty acids.

Several examples of detergent formulations which have been used in the practice of the present invention are set forth in Table II below, the percentages being on a weight basis.

TABLE II

Detergent Formulations

		(1)	(2)	(3)	(4)	(5)	(6)
Detergent	A	37.0	41.0	—	—	25.0	—
„	B	—	—	48.0	31.0	—	41.0
„	C	8.0	8.5	—	—	—	—
„	D	—	—	12.0	11.0	8.0	12.0
„	E	—	—	—	5.0	—	—
Propylene glycol		—	—	—	—	—	16.0
Ethanol		10.0	—	—	—	23.0	—
H_2O, perfume, and colouring		45.0	50.5	40.0	53.0	44.0	31.0

In the above table, detergents A to E were as follows:

A: Ammonium salt of the sulphated condensation product of one mole of middle-cut coconut alcohols, containing about 2%—C_{10}, 66%—C_{12}, 23%—C_{14}, and 9%—C_{16} alcohols, with 3 moles of ethylene oxide.

B: Sodium salt of the sulphated condensation product of one mole of middle-cut coconut alcohols, containing about 2%—C_{10}, 66%—C_{12}, 23%—C_{14} and 9%—C_{16} alcohols, with 3 moles of ethylene oxide.

C: Alkyl dimethyl amine oxide of middle-cut coconut alcohols containing substantially 2%—C_{10}, 66%—C_{12}, 23%—C_{14} and 9%—C_{16} alcohols.

D: Coconut monoethanol amide of coconut fatty acids having a carbon chain length distribution of substantially 8%—C_8, 7%—C_{10}, 48%—C_{12}, 7%—C_{14}, 9%—C_{16}, 2%—C_{18}, 7%-oleic, and 2% linoleic (the first fatty acids listed being saturated).

E: Sodium salt of the sulphonated reaction product of a mixture of 4 parts by weight of middle-cut coconut alcohol (containing approximately 2%—C_{10}, 66%—C_{12}, 23%—C_{14}, and 9%—C_{16} alcohols) and 3 parts by weight of tallow alcohol (derived from tallow-fatty acids approximately 2.5%—C_{14}, 28%—C_{16}, 23%—C_{18}, 2% palmitoleic, 41.5%-oleic and 3% linoleic—the first three acids listed are saturated) with epichlorohydrin.

Of the detergent formulations set forth in the table above, Formula (1) is the formulation employed in the preferred practice of the present invention, although the remainder of the tabulated formulations and other of similar type can be employed.

The test results reported herein were obtained by the following methods:

The wet tensile strengths were obtained by a method adapted from that set forth in the Official Standard method of the Technical Association of the Pulp and Paper Industry, entitled "Tensile Breaking Strength of Paper and Paperboard" and designated as T 404 m—50. The standard method was modified in that the distance separating the clamps was reduced to 4 inches instead of 1.1 ± 0.4 inches. Further modifications consisted of using test specimens having a width of one inch and wetting the specimen thoroughly on both sides with water after clamping it in the test apparatus. The results are reported in grams per inch of test specimen width.

Similarly, the wet mullen burst test data were obtained by an adaptation of the Official Standard method, designated as "Bursting Strength of Paper", T 403 m—53, wherein the test specimen was thoroughly saturated with water prior to clamping it in the test apparatus. The results are reported as the average pounds per square inch necessary to rupture the test specimens.

The tear test data were obtained by an adaptation of the standard method, entitled "Internal Tearing Resistance of Paper", T 414 m—49. The standard method was modified by using 8 or 16 sheets per test, as required for the total units to fall between 20 and 60, and by saturating the sheets prior to clamping them in the test apparatus. The results are reported as the scale units of a standard Elmendorf tearing tester necessary to tear one sheet.

The ability of a wet dishcloth to absorb water was arrived at by successively immersing and hand wringing a dishcloth and measuring the grams of water wrung from the dishcloth. The successive immersing and wringing operations were continued until such time as the weights of water wrung from the dishcloth after each immersion were substantially the same. This constant weight in grams was considered an effective measure of the water absorptive capability of a given dishcloth under normal conditions of use.

In the preferred embodiment of the present invention the individual plies of the disposable dishcloths have a total basis weight, i.e. fibre content per ream or 3000 square feet of paper, of from 15 pounds to 25 pounds, and preferably 20 pounds. Also, the preferred dishcloths have an area of at least 120 and suitably up to 250 square inches. The plies of these detergent loaded paper laminates are bonded together by a continuous open-grid pattern normally comprised of from 2 pounds to 10 pounds, and preferably 6 pounds, of a plastisol per 3000 square feet of dishcloth for a 2 ply product and a like additional amount for each additional ply. The plastisol is fused to form a pliable thermoplastic resin pattern. Preferably, the open-grid pattern renders not more than about 6% of the surface of a bonded ply non-absorbent, and said laminate has applied on its surface suitably from 12 pounds to 26 pounds, and preferably 17 pounds per 3000 square feet of an active detergent. The active detergent is desirably an anionic or nonionic detergent, or a mixture thereof, and may be applied in the form of a liquid or paste containing from about 25% to about 65%, suitably from 40% to 60% of detergent solids. Although the detergent-loaded laminates can be used as dishcloths without drying, it is preferable for packaging and handling convenience, to dry them to a moisture content of about 15% to about 25%. Perfumes can be added to the dishcloths, if desired, to enhance their attractiveness. The preferred dishcloths of this invention have a wet tensile strength of at least 550 grams per inch of width in the weakest direction, a wet mullen burst test of at least 4 pounds per square inch and a wet tear of at least 3.7 tear units per sheet. Furthermore, dishcloths formed in the preferred manner are capable of absorbing at least 20 grams per 120 square inches

of dishcloth of water from a wet surface after being thoroughly wetted and wrung out. Dishcloths formed according to this practice exhibit qualities of absorbency, softness and pliability together with scouring and wet handling characteristics especially suited to dishwashing.

The invention will be further illustrated in greater detail by the following specific examples.

EXAMPLE I

A disposable paper dishcloth is formed by printing 6 pounds per 3000 square feet of surface of plastisol formulation A from Table I in a continuous open grid pattern consisting of $\frac{3}{8}$ inch squares, the straight lines of which are at a 45 degree angle with the machine direction of the paper, on to a continuous moving web of 20 pound basis weight (basis weight = weight/3000 sq.ft.) wet-creped, wet-strength paper. The paper of this and the succeeding examples is composed of the preferred furnish containing 25% sulphite hardwood fibre, 74% Kraft softwood fibres and 1% polyamide-epichlorohydrin wet strength resin. The paper has a crepe of 2%. A second continuously moving web of identical paper is then brought into contact with the still tacky continuous open-grid pattern so as to sandwich the pattern between the two paper plies and bond them together. The so-formed laminate is then passed into an oven where the powdered thermoplastic of the plastisol is fused together and to the outer fibres of the paper plies by being subjected to a temperature of 325° F. for a period of 30 seconds. The thermoplastic is not rendered fluid by this application of heat and the plastisol retains the raised form in which it was deposited on the initial sheet. The cooled laminate is then treated by coating roll application with approximately 38 pounds per 3000 sq.ft. of detergent formulation (1) from Table II. This treating procedure results in the deposition of approximately 17 pounds per 3000 sq. ft. of detergent solids in the plies of the laminate. The treated laminate is then passed between squeeze rolls to distribute the detergent solution uniformly, following which it is passed through a drying chamber which reduces its moisture content to a value in equilibrium with the ambient air, e.g. approximately 15%. Detergent-filled disposable paper dishcloths having dimensions of 12 inches by 14 inches are then cut from the dried paper laminate and folded by conventional means. The dishcloths of this example have a wet tensile strength of 1076 grams per inch in the cross-machine direction and 1999 grams per inch in the machine direction, a wet bursting strength of 5.1 pounds per square inch, and a wet tear test of 7.1 units per sheet. The average water absorptive capability of a dishcloth formed according to this example is 36 grams per dishcloth. Substantially the same results are obtained if detergent formulation 1 is replaced by detergent formulation 3 from Table II, except that an increased amount of detergent solids will be deposited on the laminate. The dishcloth of this Example can also be prepared for packaging in the form of a roll rather than as single sheets. For convenience the rolled dishcloths are provided with transverse scoring for convenient tearing, or placed in a package with a cutter bar for the same purpose. Dry-creped papers may be substituted for the wet-creped papers of this example with substantially the same results. The dishcloths of this example are effective in cleaning soiled dishes.

EXAMPLE II.

A disposable paper dishcloth is prepared by printing 8 pounds per 3000 square feet of surface of plastisol formulation B from Table I in a continuous open-grid pattern consisting of $\frac{3}{8}$ inch squares, the straight lines of which are at 90 degree angles with and parallel to the machine direction of the paper, on to a continuously moving web of 15 pound basis weight dry-creped, wet-strength paper. The paper has a dry crepe of approximately 12%. A second continuously moving web of identical paper is then brought into contact with the still tacky continuous open-grid pattern so as to sandwich the pattern between the two paper plies and bond them together. The so-formed laminate is then passed into an oven where the powdered thermoplastic of the plastisol is fused together and to the outer fibre of the paper plies by being subjected to a temperature of 350° F. for a period of 30 seconds. The laminate is then treated by spraying it with 24 pounds per 3000 square feet of detergent formulation (2) from Table II. This treating procedure results in the deposition of approximately 12 pounds per 3000 square feet of detergent solids on and in the plies of the laminate. The treated laminate is then passed through a drying chamber which reduces its moisture content to a value in equilibrium with the air in the storage area. Detergent-filled, disposable paper dishcloths having dimensions of 15 inches by 17 inches are then cut from the dried paper laminate and folded by conventional means. The dishcloth of this example exhibits desirable wet-handling and strength characteristics as does the dishcloths of Example I. Polyethylene can be used as the thermoplastic resin in this example with substantially the same results. The detergent-filled, disposable paper dishcloths of this example have utility in washing soiled dishes.

EXAMPLE III.

A disposable paper dishcloth is formed by printing 5 pounds per 3000 square feet of surface of plastisol formulation C from Table I in a continuous open-grid pattern consisting of $\frac{1}{4}$ inch squares, the lines of which run in the machine and cross-machine directions of the paper, on to a continuous moving web of

25 pound basis weight wet-strength, dry-creped paper. A second continuously moving web of wet-strength, wet-creped paper is then brought into contact with the still tacky continuous open-grid pattern so as to sandwich the pattern between the two paper plies in the manner of Example I. The laminate is then passed into an oven where the thermoplastic powder in the plastisol is fused together and to the outer fibres of the paper plies by being subjected to a temperature of 300° F. for a period of 30 seconds. The laminate is then coated by roll application with 70 pounds per 3000 square feet of detergent formulation 5 from Table II. This roll coating procedure results in the deposition of approximately 23 pounds of detergent solids per 3000 square feet in the plies of the paper laminate. The detergent-filled laminate is then dried and cut into disposable paper dishcloths having the dimensions of 14 inches by 15 inches. These dishcloths exhibit desirable wet-strength, absorptive capacity, wet handling characteristics and cleansing power for use in the washing of dirty dishes. Uncreped towelling paper can be substituted for either of the paper plies of this Example, or both of them, to produce a paper laminate having desirable characteristics for use as a disposable, detergent-loaded paper dishcloth. The dishcloths of this example can be bonded with a plastisol wherein the thermoplastic resin is polyethylene.

EXAMPLE IV.

A disposable paper dishcloth is formed by printing 2 pounds per 3000 square feet of surface of plastisol formulation D from Table I, in a continuous open-grid pattern consisting of $\frac{1}{4}$ inch squares, the straight lines of which are at a 45 degree angle with the machine direction of the paper, on to a continuously moving web of 30 pound basis weight, wet-creped, wet-strength paper. A second continuously moving web of 20 pound basis weight, wet-creped, wet-strength paper is then brought into contact with the still tacky continuous open-grid pattern so as to sandwich the pattern between the two paper plies and bond them together. The laminate is then passed into an oven where the thermoplastic is fused in the manner of Example I by being subjected to a temperature of 300° F. for a period of 30 seconds. The laminate is then uniformly sprayed with approximately 38 pounds per 3000 square feet of detergent formulation (6) from Table II. This spray coating procedure results in the deposition of approximately 20 pounds per 3000 square feet of detergent solids in the plies of the laminate. The coated laminate is then passed between squeeze rolls to distribute the detergent solution. The detergent-filled laminate is then dried in the manner of Example I. Detergent-filled disposable paper dishcloths having dimensions of 13 inches by 17 inches are then cut and folded from the dried paper laminate by conventional means. The detergent-filled disposable paper dishcloths of this Example are useful in washing soiled dishes and in wiping soiled or wet kitchen surfaces. The $\frac{1}{4}$ inch straight-lined pattern of this Example can be replaced by a pattern consisting of undulating lines forming squares, diamonds, touching circles, and other continuous open-grid patterns while maintaining desirable dishcloth characteristics.

EXAMPLE V.

A disposable paper dishcloth is formed by printing 5 pounds per 3000 square feet of surface of plastisol formulation E from Table I on each side of a 20 pound basis weight, dry-creped, wet-strength sheet in a continuous open-grid pattern consisting of $\frac{3}{8}$ inch squares. The straight lines of this pattern are at a 45 degree angle with the machine direction of the sheet. Two 15 pound basis weight, wet-creped, wet-strength sheets are then brought into contact with the printed patterns on both sides of the sheet so that the three sheets are bonded together. The plastisol pattern is then fused at a temperature of 350° F. for five minutes. The laminate is then cooled and coated, by roller application, on each outer surface with approximately 27 pounds of detergent formulation (4) from Table II per 3000 square feet of dishcloth. This coating procedure results in a total coating of approximately 54 pounds of the detergent formulation and the deposition of approximately 25 pounds per 3000 square feet of detergent solids in the plies of the laminate. After drying in the manner of Example I, disposable paper dishcloths having dimensions of 14 inches by 15 inches are cut from the laminate and packaged. The dishcloths of this example are particularly useful in washing soiled dishes because of the increased strength developed in the plastisol pattern by the longer curing period. Uncreped towelling paper can be substituted for one or more of the plies of the dishcloth formed in this Example while retaining its essential characteristics as a disposable, detergent-loaded paper dishcloth.

WHAT WE CLAIM IS:—

1. A disposable paper dishcloth comprising a detergent-loaded paper laminate of at least two plies of towelling paper, the plies of said detergent-loaded paper laminate being bonded together by an open-grid pattern comprising a pliable thermoplastic resin, and said laminate containing one or more anionic detergents or nonionic detergents, or a mixture thereof.

2. A disposable paper dishcloth according to claim 1 in which the number of plies is two.

3. A disposable paper dishcloth according to claim 1 or 2 in which the towelling paper is crepe paper having basis weight of from 15 to 25 pounds per 3,000 square feet.

4. A disposable paper dishcloth according

to claim 3 in which the basis weight of the paper is 20 pounds per 3,000 square feet.

5. A disposable paper dishcloth according to claim 3 or 4 in which the towelling paper is a wet-creped paper containing sulphite hardwood fibres, sulphate soft wood fibres and a wet strength resin.

6. A disposable paper dishcloth according to any of the preceding claims in which the pliable thermoplastic resin is plasticized polyvinyl chloride.

7. A disposable paper dishcloth according to any of the preceding claims in which the amount of pliable thermoplastic resin bonding material between the plies is from 2 to 10 pounds per 3,000 square feet for each ply of the laminate.

8. A disposable paper dishcloth according to claim 7 in which the amount of pliable thermoplastic resin bonding material is 6 pounds per 3,000 square feet for each ply of the laminate.

9. A disposable paper dishcloth according to any of the preceding claims in which the continuous open-grid pattern of pliable thermoplastic resin bonding material is such as to render not more than 6% of the paper laminate surface in contact therewith non-absorbent.

10. A disposable paper dishcloth according to any of the preceding claims in which the laminate is coated on at least one side with from 12 to 26 pounds per 3,000 square feet of one or more anionic detergents or nonionic detergents or a mixture thereof.

11. A disposable paper dishcloth according to claim 10 in which the amount of detergent is 17 pounds per 3,000 square feet.

12. A disposable paper dishcloth according to any of the preceding claims in which the detergent is applied as a liquid detergent composition containing from 40% to 60% by weight of organic material.

13. A disposable paper dishcloth according to any of the preceding claims in which the detergent is a mixture of (1) the ammonium salt of the sulphated condensation product of one mole of middle-cut coconut alcohols with three moles of ethylene oxide and (2) an alkyldimethyl amine oxide in which the alkyl group is derived from middle-cut coconut alcohols, the middle-cut coconut alcohols in each case containing substantially 2% C_{10} alcohols, 66% C_{12} alcohols, 23% C_{14} alcohols and 9% C_{16} alcohols by weight.

14. A disposable paper dishcloth according to any of claims 1 to 12 in which the detergent is a mixture of (1) the sodium salt of the sulphated condensation product of one mole of middle-cut coconut alcohols, as defined in claim 13, with 3 moles of ethylene oxide and (2) the monoethanolamide of coconut fatty acids, the carbon chain length distribution in the fatty acids being substantially 8% C_8, 7% C_{10}, 48% C_{12}, 7% C_{14}, 9% C_{16}, 2% C_{18}, 7% oleic and 2% linoleic the first six listed fatty acids being saturated.

15. A disposable paper dishcloth according to any of the preceding claims in which the dishcloth has a wet tensile strength, as hereinbefore defined, of at least 550 grams per inch of width in the weakest direction, a wet mullen burst strength, as hereinbefore defined, of at least 4 pounds per square inch and a wet tear strength, as hereinbefore defined, of at least 3.7 units per sheet.

16. A disposable paper dishcloth substantially as hereinbefore described with reference to the Examples.

17. A process for the manufacture of disposable dishcloths which comprises printing on one ply of towelling paper an open-grid pattern composed of a pliable thermoplastic synthetic resin bonding composition, laying a second ply of towelling paper on said open-grid pattern so that the pattern is sandwiched between the plies, heating the paper laminate so formed so as to fuse the thermoplastic synthetic resin and to bond the outer fibres of the facing surfaces of said plies to said open-grid pattern, treating said paper laminate on at least one surface with detergent solids applied in a liquid formulation, and drying the detergent treated paper laminate.

18. A process according to claim 17 in which the dried laminate is perfumed before packaging.

19. A process according to claim 17 or 18 in which the finished laminate is packaged in roll form.

20. A process according to claim 17 or 18 in which the finished laminate is cut into sheets of area at least 120 square inches.

21. A process for the manufacture of detergent-loaded disposable paper dishcloths substantially as hereinbefore described with reference to the Examples.

22. A detergent-loaded disposable paper dishcloth when prepared by a process according to any of claims 17 to 21.

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1035475 COMPLETE SPECIFICATION
1 SHEET This drawing is a reproduction of the Original n a reduced scale

FIG. 1

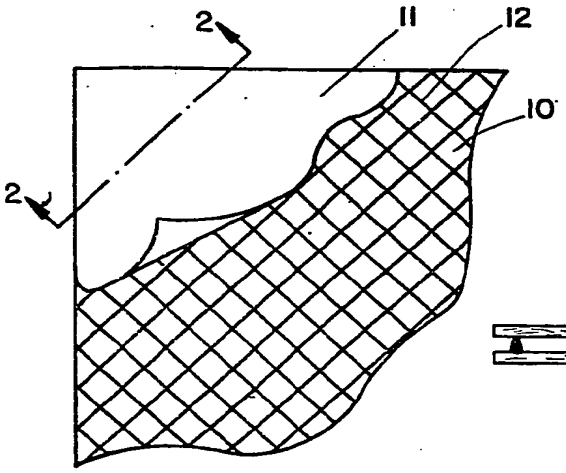

FIG. 2

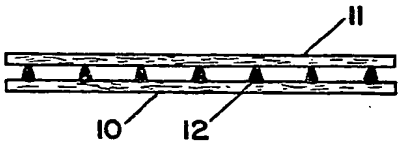

FIG. 3

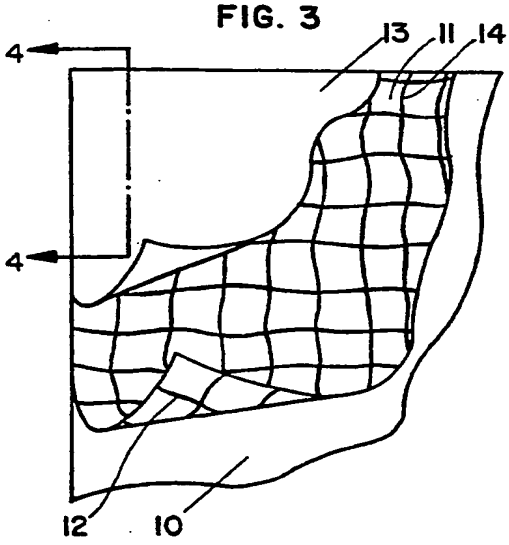

FIG. 4